UNPUBLISHED PRELIMINARY DATA

QUARTERLY STATUS REPORT No. 2

Period 14 October 1964 - 13 January 1965

MODIFICATION OF 82-INCH COUDE SPECTROGRAPH AT McDONALD OBSERVATORY

Contract NASr-230

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The purpose of this contract is to convert the McDonald Observatory 82-inch coude spectrograph from an inefficient and cumbersome instrument almost useless for planetary work into one competitive with the best coude spectrographs elsewhere, and one which is well-adapted to planetary work.

A. Review of Progress Prior to this Reporting Period

On completion of the basic contract negotiation in July 1964, detailed designs were immediately prepared and a contract was let for the essential external modifications to the observatory dome floor, revolving dome platform, coude room and coude rail extension. The testing program of the 82-inch optics during this period became a refiguring program, in which J. Texereau refigured all the secondary optics of the 82-inch. At the conclusion of the last reporting period, he also tested the optics of the coude spectrograph, verifying that they would indeed permit a desired enlargement of the collimator beam.

B. Progress during the Present Reporting Period

When the project was first scientifically agreed upon more than a year ago, it seemed likely that all of the work could be carried out in time for the modified spectrograph to be available for the important Mars velocity quadrature in December 1964. However, by the time the contract negotiations were complete in July, it was clear that we ran a serious risk of having the spectrograph by December in a totally inoperable condition if we attempted to modify its optics and internal structure in so short a remaining time.

Accordingly, the decision was reluctantly reached to carry out only the external modifications of the spectrograph and to install new gratings, in order to be sure to have this work completed and the spectrograph back in operation in time for the December velocity quadrature. The spectrograph should remain in this form through opposition and the May velocity quadrature; the summer and autumn of 1965 should be used to complete the internal modifications to the spectrograph, leaving it then in the desired fully competitive position with the best coude spectrographs elsewhere.

Despite the full-time energetic efforts of the personnel at McDonald (notably Texereau, M. Krebs, C. Knuckles, and E. Webster), and the extremely cooperative, hard-working, and effective contractor (Metal Specialties, Inc.

of Odessa, Texas), it proved just possible to complete:

1. Cutting and refinishing the floor and lower room ceilings to allow for the expanded coude space,

2. Removing the moving stairs from the dome,

3. Construction of the complete new catwalk around the dome to replace the stairs,

4. Tearing out the old coude room, and replacing it with a new one,

5. Replacing and sliding the coude spectrograph back partially toward its final new position in order to generate the necessary working space between the slit and the south pier of the telescope,

6. Rough realigning of the spectrograph,

7. Setting up of new finding, guiding and comparison arc systems, and designing, fabricating and installing of new grating holders.

These jobs were all essentially accomplished by December 5, in time for the observers to begin the final adjustments, tests of new grating orientation and exposure time, etc. necessary to carry out their program during the Mars velocity quadrature.

C. Results of Changes so far

Coude images of superb quality, permitting during moments of good seeing some of the highest resolution pictures of planets ever previously taken, can now be obtained with the 82-inch.

Realignment of the optics, and improvement of finding techniques, have made it possible now to easily find, set and guide on objects including planets which were formerly difficult with the spectrograph (the principal reason why it had been so seldom used in the 15 years of its existence).

The new coude room is a more stable enclosure thermally than before, and yet is a much more convenient one in which to make adjustments, replace plates, etc., giving more satisfactory over-all performance.

The new gratings give a better range of dispersions and greater efficiency than the single old tarnished Wood grating previously in use.

D. First Results of Observations

A At the close of this reporting period, an unusually long observing run (24 December 1964 - 8 January 1965) was assigned to one of the most competent of planetary astronomers, Dr. Hyron Spinrad (formerly of the Jet Propulsion Laboratory, now of the University of California at Berkeley),

and as his assistant a recent PhD astronomer who wishes to learn the techniques for obtaining and studying high dispersion spectra, Dr. Ronald Schorn (Jet Propulsion Laboratory).

Schorn came two weeks early to help in the final setting up and alignment of the spectrograph and gratings, and to develop the hypersensitization and calibration procedures for the plates, aided by the resident astronomer at the Observatory, Mr. Claude Knuckles, and others of the staff as needed. There was just time for the near-completion of these jobs before the start of the observing run; several of the first days of the run after the arrival of Spinrad were spent in refining the adjustments. When the weather became very good in the latter half of this run, it was possible on every night to obtain a substantial number of plates of objects of interest, of course concentrating (when Mars was up) on the search for water vapor and other constituents in the Martian atmosphere, as revealed by the unusually large and favorable Doppler shift caused by the relative radial velocities of Earth and Mars. Although the required exposures were long with seeing not always good enough to permit optimum guiding, and although the only available image rotator could not be satisfactorily used in its jerry-rigged temporary mounting, several spectra of Mars of quality comparable with Mount Wilson and Lick spectra were obtained. In view of the interest of these observations, and to take continued advantage of the unusually long and favorable velocity quadrature, another twelve days of observations were scheduled for the same group in late January. While that period actually falls into the beginning of the third quarterly report period, it should be mentioned here that the entire Southwest experienced a virulent January; on only about three nights of this second two weeks could reasonable spectra be obtained. Accordingly, it was not possible to add much material to the favorable earlier run of late December and the first week of January.

While interesting suggestions of spectral features appear on several of the plates, it would be premature to draw conclusions before analysis is completed. Initial reductions are being carried out by Dr. Schorn, under the guidance of Dr. Spinrad and to a lesser degree of Dr. G. Munch at Cal Tech.

E. Personnel Connected with the Contract

During this reporting period, the full or part-time employees under the contract included:

1. Claude Knuckles — resident staff astronomer, spent most of his time helping with the testing, realigning, and calibration of the modified spectrograph.

2. Eddie Webster — a versatile technician, played a very important role in making possible the rapid completion of the external modifications.

3. Charles Seeger — developed detailed plans for the new coude scanner, and for the testing of photomultipliers.

4. Douglas Bynum – design engineering.

5. Jack Sedwick – layout and drafting.

In addition, staff on The University of Texas payroll who have contributed time to this project during this reporting period include: the Project Director, Marlyn Krebs, Dr. Robert Tull, plus various drafting, engineering and other assistants at McDonald and at Austin.

F. Financial Report

NASA Form 1030 (2-64) for this contract is submitted quarterly by the Auditor's Office of The University of Texas.